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Does Problem-Solving Training for Family Caregivers Benefit Their Care Recipients With Severe Disabilities? A Latent Growth Model of the Project CLUES Randomized Clinical Trial

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Abstract

Objective—To examine whether an individualized problem-solving intervention provided to family caregivers of persons with severe disabilities provides benefits to both caregivers and their care recipients.

Design—Family caregivers were randomly assigned to an education-only control group or a problem-solving training (PST) intervention group. Participants received monthly contacts for 1 year.

Participants—Family caregivers (129 women, 18 men) and their care recipients (81 women, 66 men) consented to participate.

Main Outcome Measures—Caregivers completed the Social Problem-Solving Inventory–Revised, the Center for Epidemiological Studies-Depression scale, the Satisfaction with Life scale, and a measure of health complaints at baseline and in 3 additional assessments throughout the year. Care recipient depression was assessed with a short form of the Hamilton Depression Scale.

Results—Latent growth modeling was used to analyze data from the dyads. Caregivers who received PST reported a significant decrease in depression over time, and they also displayed gains in constructive problem-solving abilities and decreases in dysfunctional problem-solving abilities. Care recipients displayed significant decreases in depression over time, and these decreases were significantly associated with decreases in caregiver depression in response to training.

Conclusions—PST significantly improved the problem-solving skills of community-residing caregivers and also lessened their depressive symptoms. Care recipients in the PST group also had

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reductions in depression over time, and it appears that decreases in caregiver depression may account for this effect.

Keywords

caregivers; brain injury; disability; randomized clinical trial; problem-solving

Introduction

Family caregivers occupy a critical role in providing health care services to individuals with severe disabilities living in our communities, serving as the "… backbone of our country's long-term, home-based, and community-based care systems" (Carter, 2008, p. 1). The market value of their unpaid services roughly doubles that spent on homecare and nursing home services (Arno, 2006). Family centered models of health service delivery recognize that family caregivers essentially function as de facto health providers (Levine, Halper, Peist, & Gould, 2010; Shewchuk & Elliott, 2000; Weihs, Fisher, & Baird, 2002). To ensure their ability to perform their roles (including adhering to complex medical tasks and ensuring care recipient adherence to therapeutic regimens; Donelan et al., 2002), programs are needed to educate and support these caregivers in the home by providing appropriate training and guidance (Shewchuk & Elliott, 2000). Research is also needed to deepen our appreciation of the ways in which caregiver health and well-being influence the health and quality of life of care recipients (Levine et al., 2010).

Family caregiver coping styles, family closeness and mutually supportive relationships, direct communication about the condition and its management, and problem-solving capacity are important protective factors for families living with chronic health conditions (Weihs et al., 2002). A large body of research, grounded in a theoretical model of social problem-solving abilities (D'Zurilla, Nezu, & Maydeu-Olivares, 2004), indicates that family caregivers of persons with severe disabilities benefit from training in problem-solving principles. The social problem-solving model features testable hypotheses, a supportive literature base, a psychometrically sound measure, and clear directions for caregiver interventions that can be tailored to "… meet the specific needs and characteristics of individual families" (Campbell, 2003, p. 276). This cognitive–behavioral model focuses on the importance of fostering the effective application of both problem-solving attitudes (problem orientation) and specific problem-solving skills (problem-solving style; D'Zurilla et al., 2004). Problem orientation is a motivational set reflecting a person's generalized expectancies and emotional reactions to everyday challenges and one's abilities to meet these challenges. Problem-solving style reflects a person's ability to rationally apply four problem-solving skills: defining a problem, generating alternative solutions, deciding on a solution, and implementing and evaluating the solution plan. Results from several randomized clinical trials (RCTs) substantiate the effectiveness of problem-solving training (PST) in lowering distress experienced by family caregivers of children with brain injuries (Wade, Carey, & Wolfe, 2006a), stroke survivors (Grant, Elliott, Weaver, Bartolucci, & Giger, 2002), persons with spinal cord injuries (Elliott & Berry, 2009; Elliott, Brossart, Berry, & Fine, 2008), and mothers of children with chronic severe illness (Sahler et al., 2005).

Most of this work has relied on individual-level data that typically "… fail to capture the complexities of family life that include dyadic-level processes that influence family health and well-being" (Carr & Springer, 2010, p. 755). There is reason to suspect, for example, that caregiver problem-solving abilities and caregivers' response to PST may benefit care recipients in ways that are not yet understood. Cross-sectional evidence indicates that patients with congestive heart failure are more likely to be depressed if their spouse displays

ineffective problem-solving abilities (Kurylo, Elliott, DeVivo, & Dreer, 2004). Care recipients are at risk for developing preventable pressure sores over the first year of spinal cord injury if their caregivers report careless and impulsive ways of solving everyday problems during the initial inpatient rehabilitation program (Elliott, Shewchuk, & Richards, 1999). In another cross-sectional study, persons with traumatic brain injury (TBI) had significantly more functional deficits in social participation when their primary caregiver had a passive coping style (Van Baalen et al., 2007).

Moreover, an innovative, online intervention for families of children with brain injuries demonstrated that PST for these families was associated with improvements in child self-management and behavior problems (particularly among the older children; Wade, Carey, & Wolfe, 2006b). These results were congruent with a theoretical expectation that families receiving training strategies to solve problems associated with pediatric brain injury would have subsequent positive effects on the care recipients. Results from another RCT that also utilized long-distance technology to provide caregivers with PST indicate that beneficial effects may not be associated with specific program content, or with caregiver improvements in problem-solving abilities. Care recipients with family caregivers who received PST demonstrated significant improvement in social functioning over the 12 months of treatment (Elliott et al., 2008). Although these caregivers reported significant decreases in depression in response to PST, they did not experience significant changes in their problem-solving abilities.

The present study was conducted to increase our understanding of the ways in which PST for family caregivers affects not only family caregivers but also their care recipients. Specifically, data from a series of RCTs utilizing the same methodology and protocol at a single site were analyzed to examine dyadic responses to PST provided to family caregivers. The trials were conducted as a part of Project CLUES (*C*aregiver *L*inks to *U*nderstanding, *E*ducation, and *S*upport), supported by funds from three funding agencies. One of the agencies funded a RCT specifically for family caregivers of persons with TBIs. Another RCT was funded for family caregivers of women with severe disabilities (broadly defined). The present study relies in part on previously published data that demonstrate the beneficial effects of PST on family caregivers of persons with TBI (Rivera, Elliott, Berry, & Grant, 2008) and of women with severe disabilities (Elliott, Berry, & Grant, 2009). Neither report examined care recipient outcomes; both examined intraindividual trajectories of change among caregivers receiving PST and the control group experience.

Building upon this prior work, the present study has several unique features. First, use of combined participant data from Project CLUES permits a sophisticated analysis of dyadic processes that may occur in response to PST over time. Latent growth modeling can be used for this purpose, but for sufficient power an adequate sample size is required. Most RCTs of family caregivers of persons with specific disabilities are hampered by a low number of participants that reflect the relatively low incidence of persons with these conditions (e.g., spinal cord injury; Ramkumar & Elliott, 2010). The present study includes an adequate number of participants for our analyses, and it can potentially allow us to obtain evidence of the possible “portability” of PST for use across a variety of caregiver scenarios (see Campbell, 2003).

Method

Recruitment

Family caregivers of persons with severe disabilities were recruited from newspaper advertisements, public service announcements in local radio stations, home-health agency referrals, and mailings throughout Alabama, Georgia, Mississippi, and Tennessee. Families

were also informed of the study during visits at rehabilitation hospitals in Birmingham, AL, Tupelo, MS, and Warm Springs, GA. Mailings and flyers were also provided to the United Cerebral Palsy office in Birmingham, AL, the Alabama Head Injury Foundation, and a home health agency in Atlanta, GA for distribution.

Interested individuals contacted project staff via a toll-free telephone number to discuss eligibility. A project coordinator traveled to the individual's home to discuss details of the study, to confirm eligibility, and to obtain signed consent from both the caregiver and care recipient. To be eligible to participate, both the caregiver and care recipient had to be at least 18 years old. The caregiver had to be a family member (or "fictive kin") who was identified as a caregiver by the caregiver and care recipient, living in the same household as the care recipient. Care recipient severity of disability was not directly assessed but was inferred from the amount of care needed. To be eligible for participation, caregivers had to be providing part-time or full-time care as determined by the Supervision Rating Scale (Boake, 1996). No care recipient could be left alone for all of their waking hours. Participants had to have a telephone at home to be in the project. Participants had to agree to randomization to one of two groups (PST or control), and they were informed of project staff's duty to report any suspected or observed abuse of the care recipient.

Prospective participants were informed that the PST group would entail four home visits and monthly telephone sessions (in the alternate months) with a staff member who would teach them problem-solving skills. The control group was described as an education-only experience, and the PST would be offered to participants assigned to the control group upon completion. All participants were informed that a project staff member would be available to them at a toll-free telephone number. Participants understood that their involvement would require a 12-month commitment and that questionnaires would be administered to them on four different occasions. Participants were also informed that they would receive a financial stipend for their involvement.

A second appointment was set for a trained examiner to visit the consenting caregiver to administer the baseline measures. All assessments were conducted in regularly scheduled intervals with a data collection specialist; similarly, the assigned interventionist or control group specialist contacted their participants in regular intervals throughout the subsequent 12 months.

Figure 1 presents the number of caregivers who expressed some interest in the study and who were assessed for eligibility. Of the 411 caregivers expressing interest, 122 did not meet inclusion criteria; 67 did not reply to letters or telephone messages, or did not keep the initial appointment; and 58 declined to participate once informed of the study. Internal review board guidelines and privacy assurances prevented any systematic collection of personal information from interested individuals who were ineligible or who declined to participate.

Participants

Consenting participants included 18 men (12.2%) and 129 women (87.8%) in caregiver roles for a person with a disability. Caregivers averaged 132 months in their caregiving roles (SD = 158.5, median = 55 months, range 3–708 months). Caregiver ages ranged from 24 to 83 years (M = 56.6, SD = 12.5), and their formal education ranged from 7 to 22 years (M = 13.5, SD = 2.68). The sample included 110 Caucasian (74.8%), 35 African American (23.8%), and 2 Hispanic (1.4%) caregivers. Ninety-two caregivers were married, 28 were divorced, 18 were widowed, 4 were separated, and 5 were single. The majority of caregivers were mothers (n = 74; 50.3%) of the care recipient. Other caregivers were husbands (n = 14), wives (n = 4), daughters (n = 2), fathers (n = 2), sisters (n = 7), aunts (n = 2), or

grandparents (n = 3) of the care recipient, and 39 individuals described their relationship as "other." To ensure that consenting caregivers could understand the verbal instructions and written materials, we administered the Folstein Mini Mental Status Examination (MMSE; Folstein, Folstein, & McHugh, 1975); the caregivers averaged 28.7 on the Folstein examination (SD = 1.70; range 20–30).

Care recipients were 81 women (55.1%) and 66 men (44.9%) with a variety of disabilities. Their mean age was 44.9 years (SD = 21.2, range 19–91 years). Persons with TBIs constituted a significant percentage in each group, comprising 45.5% of the total sample. Other common disabilities included stroke (17.6%) and cerebral palsy (7.4%), and the other participants had a variety of neurological or developmental disabilities (e.g., Alzheimer's disease, mental retardation, muscular dystrophy). Care recipients averaged 12.1 years of education (SD = 3.59) and their mean Folstein Mini Mental Status Examination score was 19.9 (SD = 9.28). The care recipient sample included 113 Caucasians (76.9%), 33 African Americans (22.4%), and one Hispanic individual. Care recipients did not participate in the treatment or control group experiences.

Procedure

Random assignment—Simple randomization was used to assign participants to the PST group or to the education-only control group. The project manager responsible for treatment allocation had no information about the participants at the time of randomization. Seventy-four caregivers were randomly allocated to the PST group and 73 to the control group (see Figure 1).

Problem-solving training—In the PST group, a trained interventionist made monthly contact with an assigned caregiver. In-home PST sessions were conducted at months 1, 4, 8, and 12, and telephone sessions were conducted once a month on the alternate 8 months.

The PST protocol was adapted from previous intervention studies (e.g., Grant et al., 2002; Kurylo, Elliott, & Shewchuk, 2001; Nezu, Felgoise, McClure, & Houts, 2003). In the initial face-to-face session in the home, the five basic principles of the social problem-solving model were described (identifying the problem, brainstorming solutions, critiquing the solutions, choosing and implementing a solution, and evaluating the outcome; D'Zurilla & Nezu, 1999). To help caregivers identify and prioritize problems unique to their situation, the interventionist used a card-sort task that presented problems obtained in focus groups conducted with caregivers of people with various disabilities (Elliott & Shewchuk, 2000). The interventionist helped the caregiver discuss feelings associated with the problem and generate a list of possible solutions to address the problem and any negative feelings associated with it.

The PST protocol was designed to address elements of constructive problem-solving (including identifying and prioritizing problems, regulating emotional experiences, attending to negative and positive cognitions, brainstorming and evaluating solutions, and using instrumental, rational problem-solving skills; D'Zurilla et al., 2004). The interventionist recorded reactions for each step of the protocol and made notes about the interaction directly on the script for use in future sessions. The project coordinator reviewed interventionist notes to ensure that the caregiver received training in specific problem-solving techniques in each session.

Telephone sessions were based on scripts used in a previous PST protocol (Grant et al., 2002). A worksheet provided guidelines and prompts for each session. After the initial greeting, the interventionist discussed the value of a positive orientation for solving problems (including optimistic attitudes and positive emotions) and for being a caregiver

(while acknowledging caregiving as a challenge). Next, the interventionist reviewed any progress on the problems, goals, and planned activities identified in the previous session. This required a review of the problem-solving plan and an evaluation of its relative success. The interventionist assisted the caregiver in identifying current problems and feelings associated with them. The caregiver explored possible solutions and goals with the interventionist, and developed plans, goals, and activities to address each problem and any negative feelings associated with it.

The interventionist was a middle-aged Caucasian man with a graduate education and no prior experience in formal counseling. Prior research has shown that PST can be effectively provided by professionals with no formal training in psychotherapy or counseling (e.g., nurses; Grant et al., 2002). The project coordinator (a Latino American woman with a Ph.D. in clinical psychology) trained the interventionist in the problem-solving model and the PST protocol, and supervised the interventionist on two home visits, for approximately 30 hr of total training.

Education-only control group—Caregivers in the control group received monthly telephone calls from a control group specialist. During these structured telephone conversations (typically 10–15 min each), the caregiver and educator reviewed previously mailed health-education materials. Topics included family disaster planning, emotions, humor, relaxation, health and wellness, dental health, osteoporosis, exercise, respite, pain, stress, and long-term care. The control group experience was designed to engage participants sufficiently over a 12-month period and to provide a bona fide treatment alternative to PST (as PST has not been consistently more effective than bona fide treatment alternatives; Malouff, Thorsteinsson, & Schutte, 2007). The control group was designed to approximate a reasonable treatment alternative, because there are no community-based programs routinely available to family caregivers of persons with severe disabilities.

Two middle-aged Caucasian men served as control group specialists at different times during the project. Neither had prior experience as a counselor, and neither was familiar with the principles of PST. Both were trained in the specific topics to be covered and in the use of the educational manual and control group protocol. Inspection of their session notes revealed that neither discussed any aspect of the social problem-solving model with participants.

Assessments—Two individuals were trained to conduct assessments with participants. One examiner, who conducted assessments in the first 4 years of the 5-year project, was a Caucasian woman with a bachelor's degree in psychology. The second examiner, who conducted assessments in the final year of the project, was a Caucasian woman with a Ph.D. in developmental psychology. Instruments were administered at pretreatment baseline, and at 4, 8, and 12 months of participation. Examiners were unaware of the assigned condition of each caregiver. Information from assessment batteries was not shared with the interventionist or control group specialists. The project coordinator supervised the interventionist, control group specialists, and the examiners in separate, routine meetings. Participants were debriefed at the final assessment.

Instruments

Caregiver depression—The Center for Epidemiological Studies Depression Scale (CES-D; Radloff, 1977) was used to assess caregiver depression. The CES-D consists of 20 items that are rated a 4-point scale to indicate how often symptoms are experienced in the preceding week. Higher scores indicate higher levels of depression.

Social problem solving abilities—The Social Problem Solving Inventory–Revised (SPSI-R; D'Zurilla, Nezu, & Maydeu-Olivares, 2002) was used to assess caregiver problem-solving abilities. The SPSI-R consists of 52 items rated on a 5-point Likert-type scale ranging from *not very true of me* (0) to *extremely true of me* (4). The SPSI-R has five scales. Two scales measure the constructive dimensions of the problem-solving model: positive problem orientation (PPO) and rational problem solving (RPS). Three scales measure the dysfunctional dimension of the model: negative problem orientation (NPO), impulsivity/carelessness (ICS), and avoidance (AS). The two positive measures (PPO, RPS) were summed to obtain an index of a constructive problem-solving style, and the three negative measures (NPO, AS, ICS) were summed to form an index of a dysfunctional problem-solving style.

Life satisfaction—The Satisfaction with Life Scale (SWLS; Diener, Emmons, Larsen, & Griffin, 1985) was used to evaluate caregiver life satisfaction. The SWLS has five items rated on a Likert-type response format ranging from 1 (*strongly disagree*) to 7 (*strongly agree*). Higher scores reflect greater life satisfaction.

Caregiver health—The general form of the Pennebaker Inventory of Limbic Languidness scale (PILL; Pennebaker, 1982) was used to assess caregiver health. The PILL contains 54 items that are rated in a yes-no format and measures health problems experienced by the individual over the preceding 3 weeks. Higher scores reflect more health complaints.

Care recipient depression—A 6-item short form of the Hamilton Depression Rating Scale (HAMD) was used to assess care recipient depressive symptoms (O'Sullivan, Fava, Agustin, Baer, & Rosenbaum, 1997). The 17-item HAMD (Hamilton, 1960) clinician-rated index of depression severity is often used in clinical research (Snaith, 1996), but the 6-item version was developed to improve measurement consistency by focusing on the core symptoms of depression (O'Sullivan et al., 1997), while minimizing sensitivity to somatic symptoms (a criticism of the full HAMD; Mölloer, 2001). It is not dependent on a person filling out a questionnaire; therefore, it is a preferred instrument for use with individuals in which cognitive or other impairments may impede assessment (Stein, Sliwinski, Gordon, & Hibbard, 1996). Internal consistencies of the 6-item HAMD have been shown to be adequate (.89 and .94 in two clinical samples), and construct validity has been supported through concurrent correlations with the full HAMD and other depression scales (Carmody et al., 2006).

Care recipient functional deficits—The severity of disability of care recipients was measured with the Functional Independence Measure (FIM; Uniform Data Set for Medical Rehabilitation, 1996). The FIM contains 13 items that assess motor function (eating, grooming, bathing, dressing, toileting, bowel and bladder control, transfers, and locomotion) and 5 items that measure cognitive function (communication and social cognition). Lower scores indicate more functional deficits.

Caregiver burden—A subset of the Caregiver Burden Scale (CBS; Oberst, Thomas, Gass, & Ward, 1989) was used to assess caregivers' perceptions of burden. The difficulty subscale measures the difficulty associated with 14 direct, instrumental, and interpersonal demands common to family caregivers. The difficulty of performing specific activities is rated on a 5-point Likert scale (1 = *none* to 5 = *a great deal*). The subscale possesses good internal consistency (Cronbach's alpha has ranged from .87–.91). Construct validity has been supported in studies of caregivers of chronically ill patients (Carey, Oberst, McCubbin, & Hughes, 1991).

Caregiver satisfaction with program—The Client Satisfaction Questionnaire (Larsen, Attkisson, Hargreaves, & Nguyen, 1979), an 8-item Likert-type scale, was used to assess satisfaction with the assigned experience. The questionnaire has demonstrated adequate internal consistencies (alphas ranging from .83–.93; Cryns, Nichols, Katz, & Calkins, 1989). Higher scores indicate greater satisfaction.

Data Analysis

We first examined the comparability of the PST and control groups on demographic, background, and initial status variables for both caregivers and care recipients. We used independent-samples *t* tests to compare groups on continuous variables, and chi-square tests of independence for categorical variables. We also constructed a correlation matrix of outcome variables at baseline. These analyses were conducted using IBM SPSS version 19 (IBM SPSS Statistics, Chicago, IL, U.S.A.).

Treatment effects were tested with latent growth curve (LGC) modeling using robust maximum likelihood estimation implemented in MPLUS Version 5.21 (Muthén & Muthén, 2007). Based on a structural equation modeling framework, latent growth models describe change over time in terms of latent intercepts and latent slopes, both of which can be treated as random variables differing between individuals. Because these latent growth parameters can be used as both predictors and outcomes, latent growth models offer great flexibility in modeling complex change processes over time (Jackson, 2010). Unlike analysis of variance methods, latent growth models estimated with maximum likelihood procedures incorporate all available data into the estimation process (rather than listwise deletion), which is an advantage in longitudinal research with dropouts and intermittent missing data.

In the present study, linear change over time was modeled for all outcomes. In initial exploratory analyses, no significant quadratic effects were found for any outcome. In our final models, a common intercept was estimated for the two treatment groups, and slopes were regressed on intercepts to adjust for any effects of initial status on rate of change. This approach is analogous to the commonly recommended analysis of covariance model for clinical trials, in which posttreatment growth is estimated while adjusting for baseline measures. In the LGC model, however, the intercept is not a raw baseline measure but rather a latent intercept estimated using data from all measurement periods. The slopes of the growth trajectory, conditional on treatment group (“Slope on treatment” in statistical tables), are the primary parameters of interest that indicate potential differential growth trajectories for the treatment conditions. In all growth models, time was coded *0, 1, 2,* or *3* over the four measurement occasions so that intercepts reflect initial levels at baseline. The PST group was coded *1*, the control group *0*. Residuals between adjacent measurement times were allowed to covary, and theses covariances were constrained to be equal across time periods. In all models, intercepts were treated as random effects and slopes as fixed effects (in almost all analyses, the inclusion of random slopes resulted in convergence problems or latent variable covariance matrices that were not positive-definite). After the initial models were fit, influential outliers were examined using significant Mahalonobis distance measures, and models were fit with outliers deleted. No more than four data points were removed from any analysis.

The relationships between caregiver outcomes and care recipient depression were assessed using two methods: parallel growth models and direct effects models. In the parallel growth models, caregiver slopes were hypothesized to predict care recipient slopes on outcome variables. In the direct effects models, caregiver outcomes at each time period were hypothesized to predict care recipient outcomes at those time periods.

Results

Demographics and Baseline Status

Table 1 provides demographic and baseline status data for caregivers and care recipients in the treatment and control groups. Caregivers in the two groups did not differ significantly on caregiver or care recipient demographics, outside help or financial assistance, caregiver burden, mental status, or care recipient mental status or functional independence. Table 2 provides descriptive statistics for outcome variables at each time period for both groups.

Table 3 presents correlations among outcome variables at baseline for the PST and control groups combined. Caregiver depression was positively associated with burden and physical symptoms, and negatively associated with life satisfaction. Consistent with previous research on social problem-solving in caregivers, caregiver depression was negatively associated with constructive problem-solving, and positively associated with dysfunctional problem-solving. Care recipient depression was correlated positively with caregiver depression and negatively with caregiver life satisfaction. The only significant correlate of care recipient functional independence was a negative association with caregiver burden.

Analyses of PST Treatment Effects

Caregiver outcomes—The results of the LGC models for caregiver outcomes are shown in Table 4 (error variances and covariances are not shown and are available from the authors upon request). In these models, statistically significant conditional slope estimates are interpreted as evidence of differential time trajectories of outcome variables for the PST and control groups. For all models, the overall fit statistics indicated acceptable fit to the data (all chi-square statistics = nonsignificant, all comparative fit indexes [CFI] > .97, all root mean square error of approximation [RMSEA] fit statistics < .08). The results indicate significant treatment group differences in slopes for caregiver depression, dysfunctional problem-solving, and constructive problem-solving. The modeled trajectories for these outcomes are shown in Figures 2, 3, and 4. As shown in Figure 2, the control group had an increasing trajectory of depression over time, while the PST group showed a declining trajectory. For dysfunctional problem-solving style, the control group remained stable while the PST group showed a declining dysfunctional style (see Figure 3). For constructive problem-solving style, the control group declined over time while the PST group increased in a constructive problem-solving style (see Figure 4). There were no significant differences between groups for health outcomes or satisfaction with life.

Care recipient depression—Table 4 includes the results of the LGC model for care recipient depression (HAMD) over time. The overall model fit was acceptable (nonsignificant chi-square, CFI = 1.0, RMSEA = .001). There was a significant treatment effect on the slope of depression. Figure 5 shows the modeled trajectories for the two groups, which indicates a stable trajectory of depression for the control group and a declining trajectory for the PST group.

Mechanisms of change in care recipient depression: Exploratory models—The finding that care recipient depression declined in the PST group is interesting given that the PST was given to the caregivers, not the care recipients. The growth model itself implies a direct causal relationship between treatment and outcomes, but such a direct causal effect on care recipient outcomes is difficult to justify on theoretical grounds. We explored several growth models that might provide a more realistic account of how PST might have affected care recipient depression. One explanation is that caregiver mood directly affected care recipient mood. One model of this possibility, a parallel process mediation model, is shown in Figure 6. In this model, caregiver and care recipient depression are modeled as parallel

growth curves, specified in our treatment effect model (except that the regression of CES-D slope on CES-D intercept had to be set to 0 to achieve convergence). Measurement errors between the CES-D and HAMD at each time were allowed to covary (and these covariances were constrained to be equal). In the model, treatment directly affects the slope of caregiver depression, but has an indirect effect on the slope of care recipient depression. This model fit the data well, $\chi^2(30) = 19.04$, $N = 145$, $p = .94$; CFI = 1.00; RMSEA = .001. The slopes of caregiver and care recipient depression were positively associated ($p < .05$), and the indirect effect from treatment to the slope of care recipient depression was significant (estimate [Est.] = −.33, $SE = .11$, $p < .01$).

An alternative, direct effects model is shown in Figure 7. In this model, the treatment model for caregiver depression is specified as previously. In addition, direct effects of caregiver depression on care recipient depression are specified at each measurement period, with these direct effects constrained to be equal across times. This model fit the data well, $\chi^2(29) = 27.3$, $N = 147$, $p = .56$; CFI = 1.00; RMSEA = .001. As shown in Figure 7, the direct effect of caregiver depression on care recipient depression was significant (Est. = .049, $p < .05$). If we relaxed the equality constraint on the direct effects over time, three of the effects remained strongly significant, but the effect at Time 2 only approached significance (Est. = .038, $SE = .02$, $p = .08$).

Both the parallel growth mediation model and the direct effects model are consistent with an emotional congruence mechanism whereby caregiver emotional state influences care recipient emotional state. This, however, is not the only possible explanation. For example, caregivers who become more effective problem-solvers might be changing the tangible quality of life of care recipients (via better physical care, emotional support, treatment regimen compliance, etc.), and these changes could be affecting care recipient mood. Unfortunately, we have no data concerning specific changes in tangible care or recipient quality of life. Caregiver problem-solving style might be considered a distal or proxy measure for possible improvement in care recipient quality of life. We replicated the parallel growth mediation model and the direct effects model described above, but using caregiver constructive and dysfunctional problem-solving measures instead of caregiver depression.

For constructive problem-solving, the parallel growth model did not provide evidence that constructive problem-solving was driving care recipient levels of depression (despite good overall model fit and a significant positive treatment effect on caregiver constructive problem-solving). The indirect effect of treatment on the slope of care recipient depression was not significant, nor were the slopes of caregiver constructive problem-solving and care recipient depression significantly associated. In the direct effects model, the relationship between caregiver problem-solving and care recipient depression at each time period was not significant (nor were these effects significant when equality constraints were removed).

For dysfunctional problem-solving, the parallel growth mediation model was similar to that for depression (see Figure 8). The overall model fit was good, $\chi^2(29) = 25.3$, $N = 145$, $p = .66$; CFI = 1.00; RMSEA = .001. Although the indirect effect of treatment on the slope of care recipient depression was significant (Est. = −.29, $SE = .12$, $p < .05$), the positive relationship between the slopes of caregiver dysfunctional problem-solving and care recipient depression only approached significance (Est. = .20, $SE = .12$, $p = .10$). For the direct effects model, the relationship between caregiver dysfunctional problem-solving and care recipient depression was not significant (nor were these effects significant when equality constraints were removed).

Supplemental Analyses

Missing data analyses—We examined the missing value patterns for the 5 major caregiver outcome variables (depression, life satisfaction, physical health, and constructive and dysfunctional problem-solving) over all testing occasions. The Subject × Time × Outcomes matrix was 68.7% complete for the whole sample (65.0% for the PST group, 72.6% for the control group). For care recipient depression outcomes, the data matrix was 54.4% complete (58.1% for the PST group, 50.7% for controls). Little's Missing Completely At Random (MCAR) test (Little & Schenker, 1995) across all six outcomes for all time periods provided support for the hypothesis that missing values occurred completely at random, $\chi^2(431) = 485.8$, $p = .17$.

TBI subgroup analyses—Previous research suggests that family caregivers of persons with TBI may have a different trajectory of response to PST compared with other caregivers. Rivera et al. (2008) found caregivers receiving PST initially experienced an increase in depression scores, and these steadily declined over time as they benefitted from PST. This stands in contrast to the "linear" decrease in depression scores experienced by other caregivers (Elliott et al., 2009; Grant et al., 2002; Wade et al., 2006a). To assess for possible differences in growth trajectories in the TBI and non-TBI subsamples in the present study, we conducted multiple-group analyses in MPLUS. No significant differences in outcome trajectories were found between these subgroups. Statistical details of these analyses can be found in the online supplemental materials.

Caregiver burden and care recipient functioning—Although we did not hypothesize that caregiver burden would be affected by treatment, we explored this possibility by estimating growth models for burden over time. The model fit the data adequately, $\chi^2(11) = 16.8$, $N = 147$, $p = .11$; CFI = .94; RMSEA = .06. However, there was no significant treatment effect on latent slopes of burden over time ($B = .46$, $SE = .68$, $p = .50$). We also tested for treatment group differences in change in care recipient functional independence over time. Because the FIM was only administered at baseline and the 12-month assessment, we used analysis of covariance to compare groups on the final FIM assessment, using baseline measures as a covariate. The adjusted mean for the PST group was 98.8 ($SE = 1.78$) and for the control group was 96.8 ($SE = 1.76$). There was no significant difference between groups, $F(1, 127) = 0.62$, $p = .44$.

Caregiver satisfaction with program—An independent-samples *t* test was used to compare the PST and control group caregivers on their satisfaction with their respective experiences in the CLUES program. The mean satisfaction rating for the PST group was 28.3 ($SD = 4.27$); the mean rating for the educationonly controls was 27.5 ($SD = 4.91$). The difference between groups was not statistically significant, $t(123) = -0.88$, $p = .38$.

Discussion

This study supports the efficacy of tailored PST in enhancing the quality of life of community-residing family caregivers of persons with severe disabilities. Caregivers receiving PST showed significant enhancement of problem-solving abilities and a reduction in depressive symptoms over time relative to education-only controls. These findings are consistent with previous studies demonstrating the benefits of PST for caregivers of persons with specific disorders such as stroke (Grant et al., 2002), spinal cord injuries (Elliott et al., 2008; Elliott & Berry, 2009), TBI (Rivera et al., 2008; Wade et al., 2006a, 2006b), and cancer (Nezu et al., 2003). This study thus provides a step toward validating the benefits of PST for caregivers across diverse medical conditions.

The changes in problem-solving skills in the PST group are consistent with the theoretical model of social problem-solving. The model emphasizes the importance of training in both constructive and dysfunctional problem-solving styles. Previous research on PST with caregivers has documented adaptive change in general problem-solving abilities (Grant et al., 2002) or in either dysfunctional problem-solving only (Rivera et al., 2008) or constructive problem-solving only (Elliott et al., 2009). In contrast, we found significant effects of PST on both problem-solving dimensions. The larger sample size (and thus greater statistical power) of the present study compared with previous work might account in part for this difference.

We also found that PST delivered to caregivers had beneficial effects for care recipients. Even though care recipients did not directly participate in PST, their levels of depressive symptoms declined over time, whereas care recipients whose caregivers were in the control condition showed a stable trajectory of depressive symptoms. This finding adds to the few clinical trials that have examined such indirect effects of caregiver interventions on the well-being of care recipients (e.g., Elliott et al., 2008; Wade et al., 2006b).

Although demonstrating beneficial effects of family interventions on care recipients is important, it is essential that interventions "… be based on theories that delineate mechanisms of change in family processes and skills … necessary to maintain patients' and family members' health" (Shields, Chawla, Finley, & Meadors, 2012, p. 265). Several mechanisms might account for the indirect benefits of caregiver PST for care recipients in our study. One possibility is that caregiver mood (which was improving because of treatment) was directly affecting care recipient mood. This phenomenon commonly goes by the name "emotional contagion" (Hatfield, Cacioppo, & Rapson, 1994). Emotional contagion refers to the convergence of somatic, behavioral, and emotional states between two or more people. Closely related terms include "affective mirroring," "emotional convergence," "emotional transmission," and "coregulation." The ubiquity of emotional contagion underlies the growing research and theorizing on the social functions of emotions (Keltner & Haidt, 1999) and the neurological and physiological basis of empathy, imitation, and affective coregulation (Decety & Meyer, 2008; Sbarra & Hazan, 2008).

There is much evidence for concordance of depressive symptoms and moods in couples and families using both cross-sectional (Joiner & Katz, 1999; Kiecolt-Glaser & Newton, 2001) and longitudinal methods (Anderson, Keltner, & John, 2003; Kouros & Cummings, 2010; Larson & Almeida, 1999; Saxbe & Repetti, 2010). In a longitudinal study of 12,067 participants in the Framingham Heart Study from 1983 to 2001, Rosenquist, Fowler, and Christakis (2010) found that levels of depression were transmitted in social networks up to three degrees of separation.

Some studies have examined emotional transmission in couples coping with health crises. Segrin, Badger, Dorros, Meek, and Lopez (2007) found that anxiety in women undergoing breast cancer treatment was consistently associated with that of their partners; the influence ran mostly from partners' anxiety to that of women with cancer. Similar findings were reported in a study of couples engaged in assisted-reproduction treatment (Knoll, Schwarzer, Pfüller, & Kienle, 2009).

In the present study, two models were consistent with a "contagion" effect of caregiver depression on care recipient depression. In the parallel growth curve model, PST directly affected the slope of caregiver depression, which influenced the slope of care recipient depression in the same direction. Thus, PST had an indirect effect on change in care recipient depression via its direct effect on change in caregiver depression. In the alternative

direct effects model, caregiver depression was influencing care recipient depression at each assessment.

There are other mechanisms that might explain the benefits of caregiver PST for care recipient well-being. Perhaps caregivers who received training in problem-solving were better able to provide effective care for their loved ones by improving their material conditions or providing better access to treatment resources. These improved conditions could have affected care recipient levels of depression. Our data did not provide evidence that change in caregiver problem-solving was related to care recipient improvements in depression, nor were there treatment group differences in care recipient functional independence. It is possible, however, that self-reported change in problem-solving abilities are an inadequate proxy for objectively measured (or care recipient-reported) positive changes in care recipient circumstances.

Another possible mechanism for the impact of PST on care recipient well-being is suggested by the concept of dyadic coping (Revenson, Kayser, & Bodenmann, 2005). Most research on caregivers has focused on individual styles of appraising and coping with stressors (Berg & Upchurch, 2007). In contrast, a dyadic coping perspective emphasizes that close dyads often perceive stressors as “ours” and engage in joint coping efforts, pooling of resources, and sharing information to bring about desired goals. In the present study, it is possible that some caregivers shared their new knowledge with their care recipients, who then applied more constructive habits to their own lives. Unfortunately, we have no means to assess this possibility. Based on the data at hand, the present study most strongly supports a model in which improvements in care recipient depression is a direct effect of improvements in caregiver depression brought about by participation in PST.

Several limitations of this study must be acknowledged. All outcome measures were based on self-reports, and the drawbacks of self-reports and the reliance on a single mode of assessment are well-known. This might be especially true for the social problem-solving scales, for which more research is needed on the relationship between verbal learning of problem-solving protocols and objectively measured problem-solving behavior (Fox & Faw, 2000). Another limitation is that participants were volunteers who had both the interest and capacity to participate in a home-based educational program. Although randomization ideally provides some control over the effects of biases in response to treatment, our sampling procedure and inclusion criteria could limit our ability to generalize results to a broader population of community-residing caregivers and care recipients. A possible limitation of the study is a lack of a generally applicable “treatment-as-usual” for community-residing family caregivers of people with diverse disabilities. It is possible that the education-only intervention did not provide a realistic control condition, a problem that perhaps extends to most clinical trials of community-based interventions for chronic health conditions. Furthermore, participants were not “masked” to their experimental condition, which could have biased some participant’s responses. It is noteworthy that although caregivers in the control group did not reap the benefits of PST for problem-solving and depression, they reported almost the same levels of satisfaction with their experience in the study. This suggests that control caregivers were provided with an engaging, bona fide alternative intervention. Finally, potential moderators of PST effectiveness, such as gender and ethnicity, were not examined in the present study because of inadequate sample sizes.

We have a final caution about the results of this study. Although the effect of PST on care recipient depression was statistically significant, the clinical significance of the change can be questioned. A few care recipients had substantial decreases in depression scores, but the average decline on the HAMD among care recipients in the PST group was 1 scale point. This is perhaps due in part to low initial levels of depression among care recipients. Our

inclusion criteria did not take into consideration caregiver or care recipient depression. Consequently, many nondepressed caregivers and care recipients participated in the study. Despite the restricted ranges on depression scales, significant treatment effects were detected. Future work may find stronger effects if the study is restricted to persons who report higher levels of distress.

Further study of dyadic adjustment following disability is necessary to understand the mechanisms of change on family processes and skills that affect care recipient health and well-being (Shields et al., 2012). If psychological well-being is indeed contagious throughout social networks, then discovering convenient and effective targeted interventions for even one family member "… might be particularly cost-effective from a societal standpoint, benefitting both them and others" (Rosenquist et al., 2010, p. 8).

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

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Impact and Implications

- This randomized clinical trial supports the efficacy of home-based problem-solving therapy (PST) in enhancing the quality of life of family caregivers of persons with diverse acquired and developmental disabilities. Furthermore, the study found that PST delivered to caregivers had indirect beneficial effects on care recipient psychological well-being.
- This study provides tentative support for an emotional contagion or affective mirroring mechanism underlying the indirect treatment effect of caregiver-targeted PST on care recipients.
- Results suggest that PST delivered to a family caregiver might be a cost-effective means of enhancing the quality of life of their care recipients.

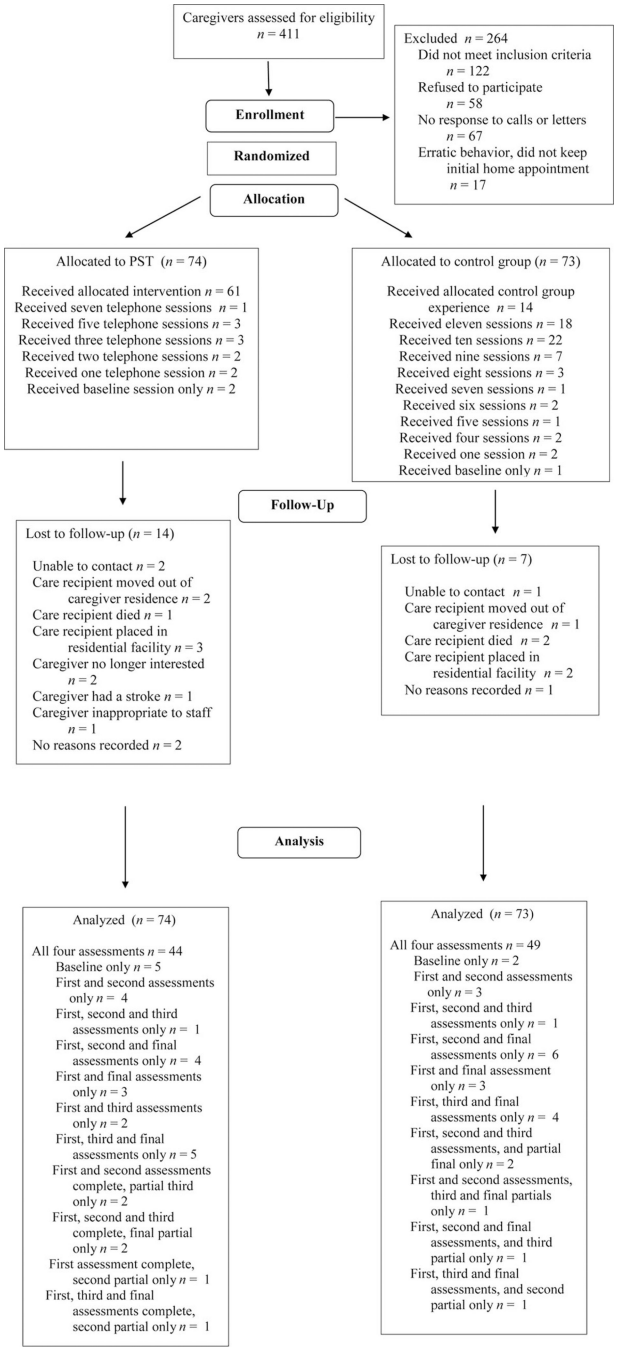

Figure 1.
The Consolidated Standards of Reporting Trials (CONSORT) flowchart.

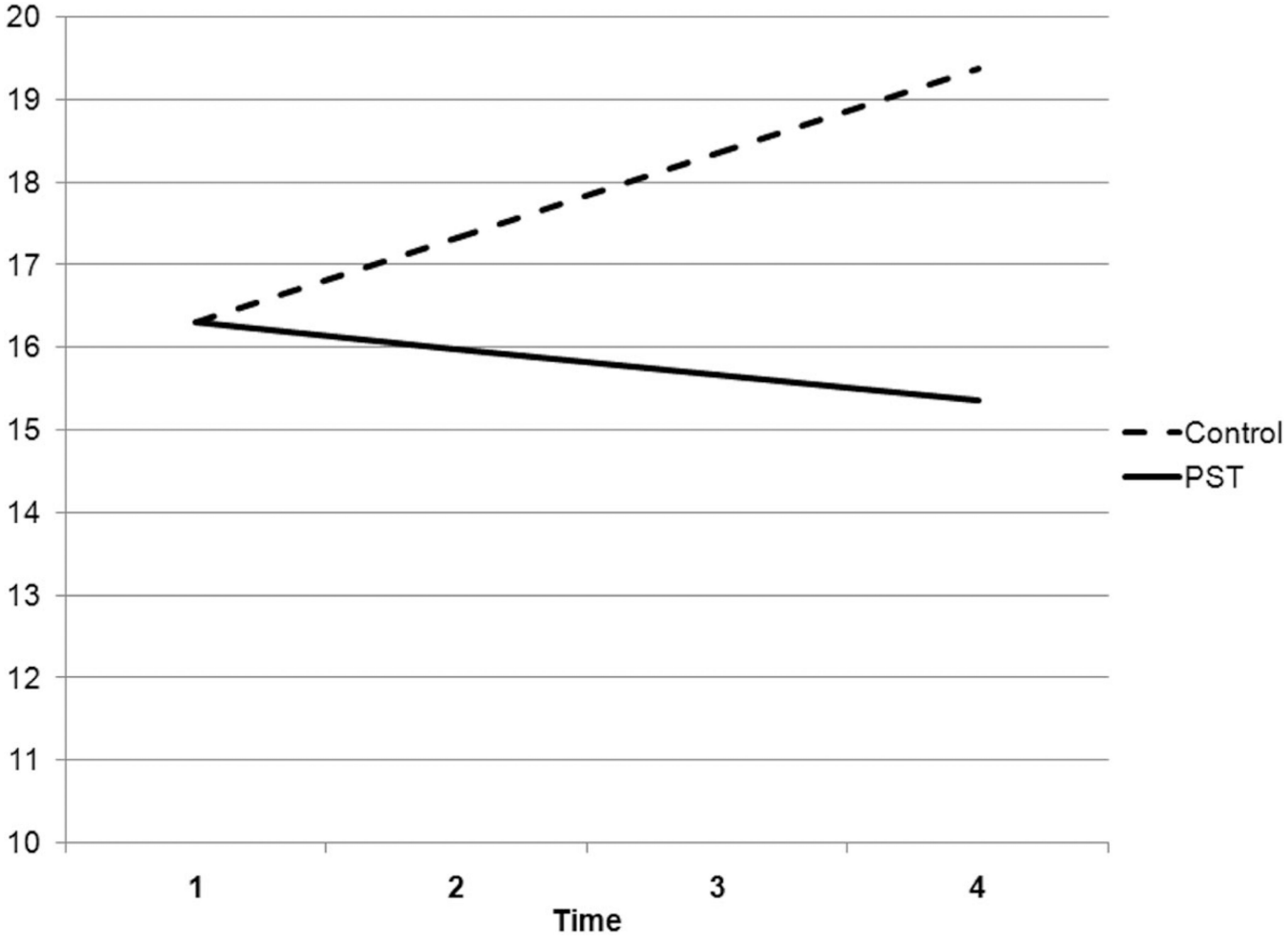

Figure 2.
Treatment group trajectories for caregiver depression (CES-D).

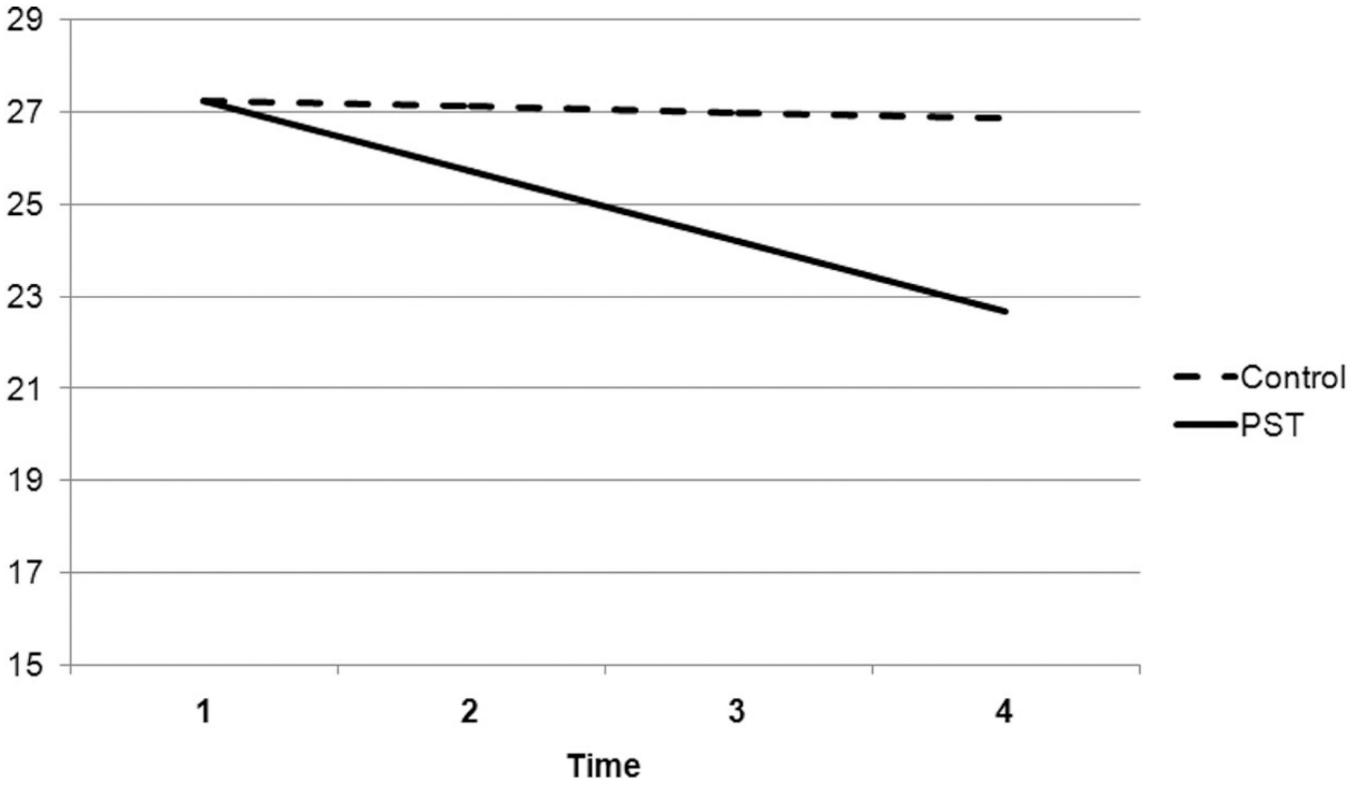

Figure 3.
Treatment group trajectories for dysfunctional problem-solving abilities.

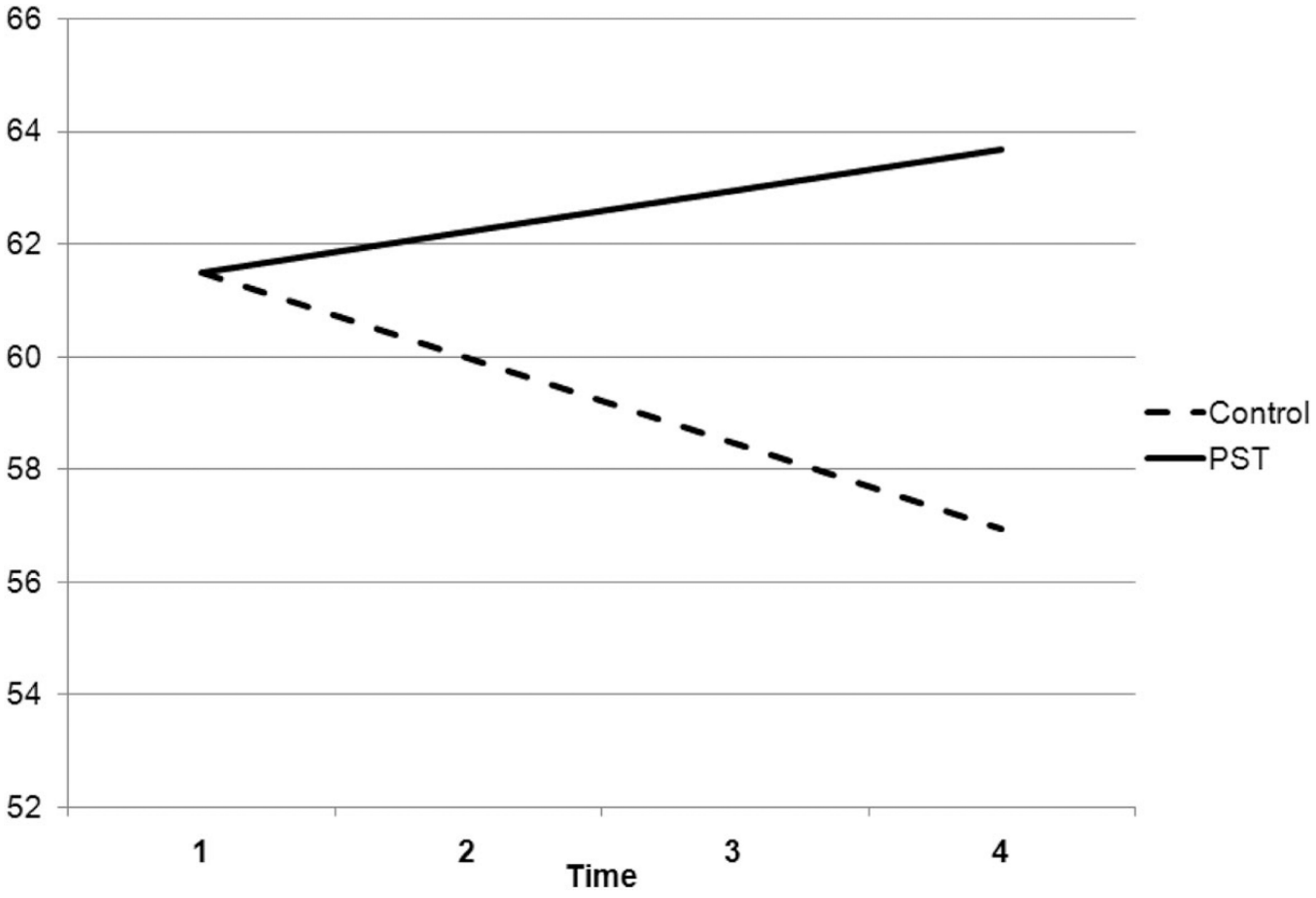

Figure 4.
Treatment group trajectories for constructive problem-solving abilities.

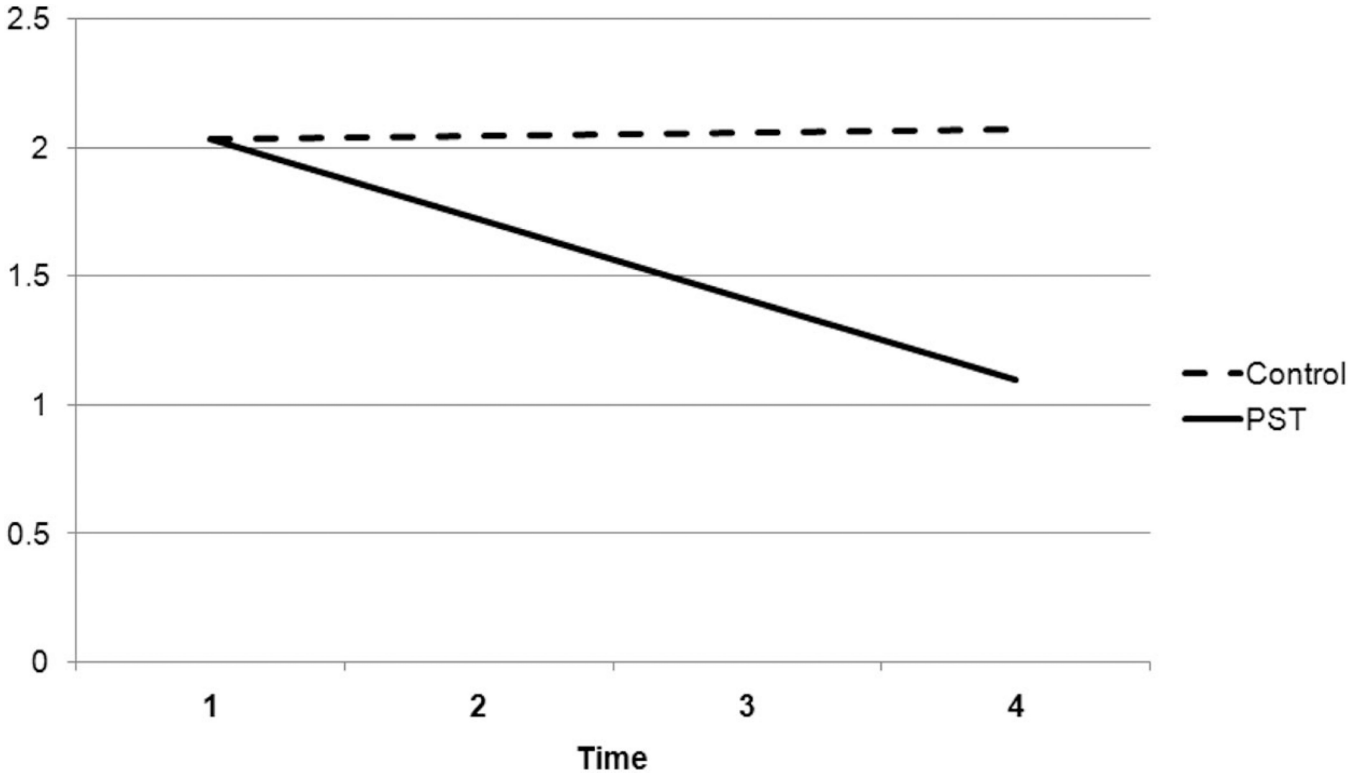

Figure 5.
Treatment group trajectories for care recipient depression (HAMD).

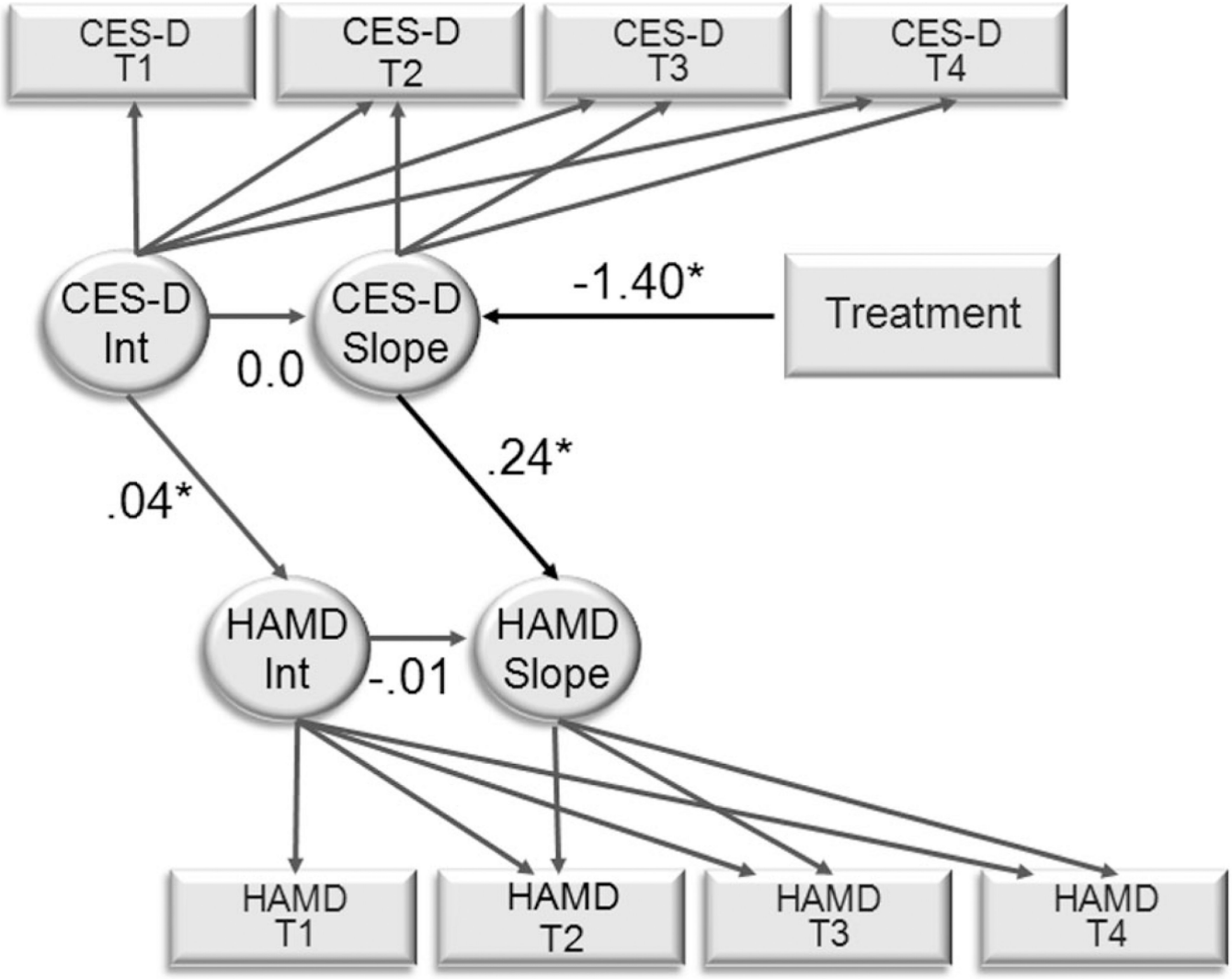

Figure 6.
Parallel growth model for effect of PST on care recipient depression via caregiver depression. * $p < .05$.

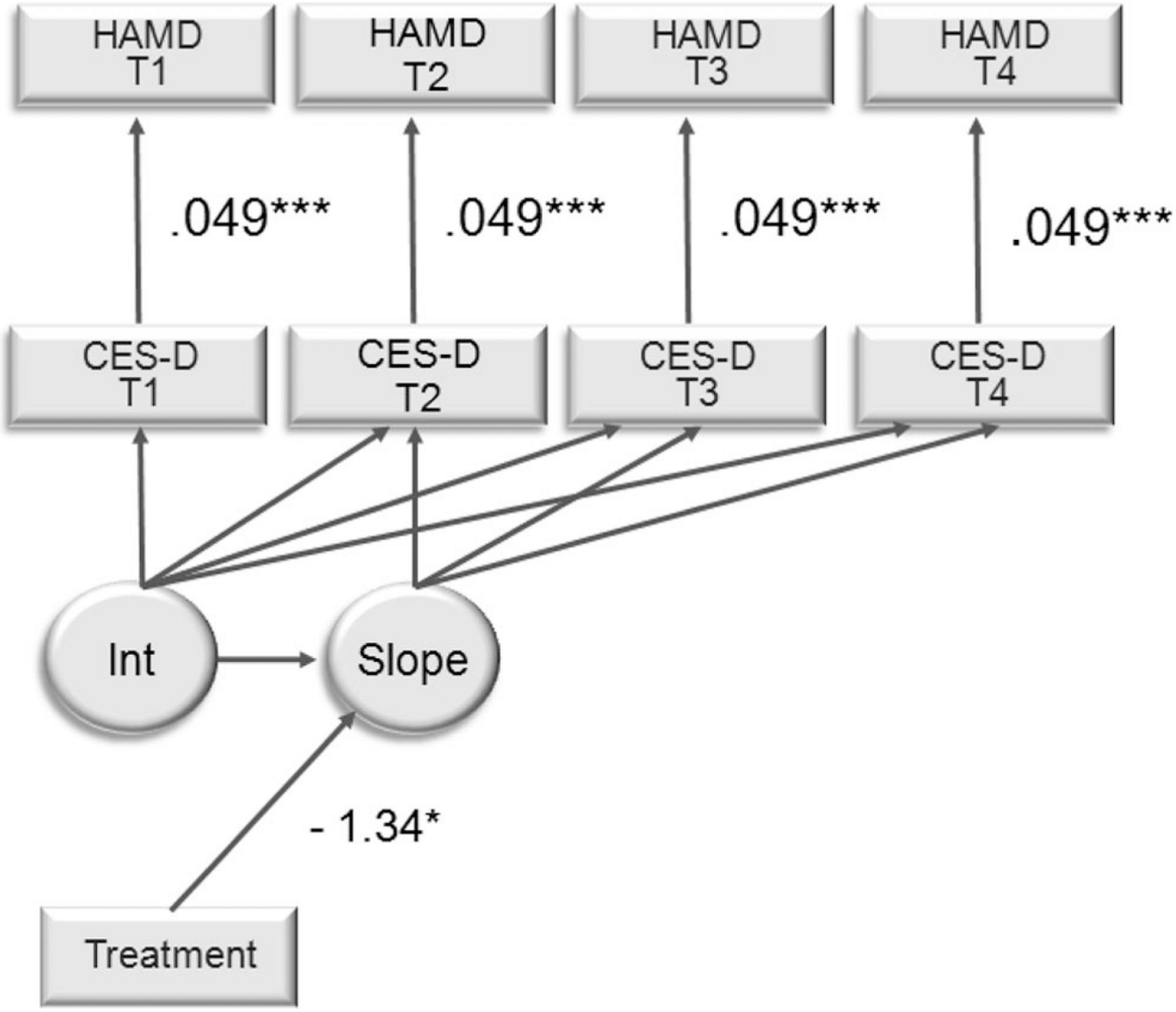

Figure 7.
Growth model of direct effects of caregiver depression on care recipient depression. * $p < .05$. *** $p < .001$.

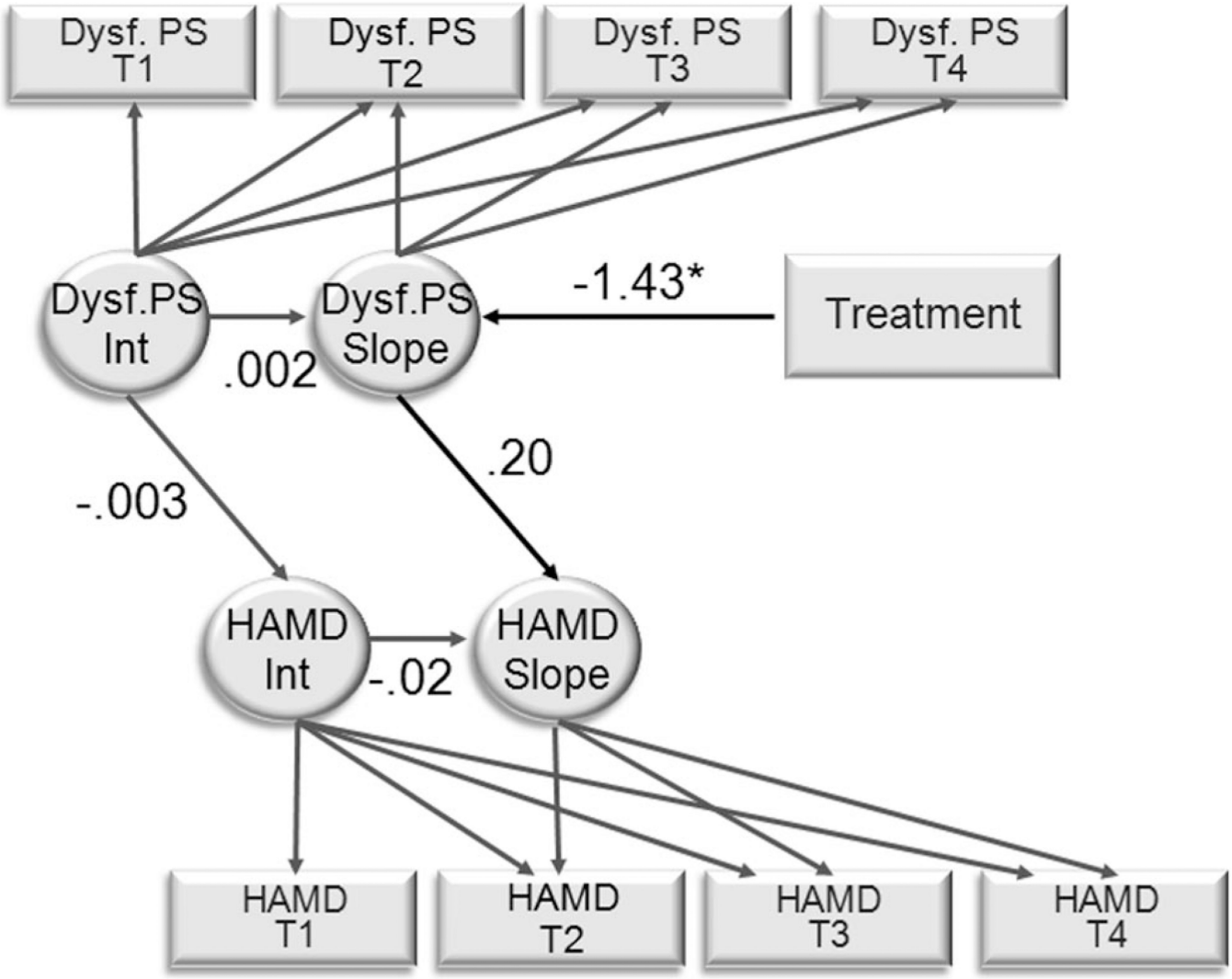

Figure 8.
Parallel growth model for effect of PST on care recipient depression via caregiver dysfunctional problem-solving. * $p < .05$.

Table 1

Demographic, Background, and Initial Status Variables by Treatment Condition

	Control (*n* = 73)		PST (*n* = 74)		
Categorical variables	***n***	**%**	***n***	**%**	**Test *p* value**
Caregivers					
Male	11	15.1	7	9.5	.30
Caucasian	53	72.6	57	77.0	.54
Married	45	61.6	47	63.5	.82
Unemployed	44	60.3	48	64.9	.57
Receiving help	16	21.9	12	16.2	.38
Care recipients					
Male	30	41.1	36	48.6	.35
Caucasian	55	75.3	58	78.4	.66
Married	22	30.1	26	35.1	.51
Unemployed	68	93.2	69	93.2	.98
Continuous variables	*M*	*SD*	*M*	*SD*	
Caregivers					
Age	56.7	13.4	56.5	11.7	.90
Years education	13.7	2.4	13.3	2.9	.40
Months caregiving	126.5	162.5	137.4	155.3	.67
Caregiver MMSE	28.6	1.7	28.9	1.9	.24
Supervision Rating Scale	6.4	1.9	6.9	1.9	.16
Burden	31.2	12.2	30.9	11.8	.91
Care recipients					
Age	46.0	22.4	43.8	20.1	.53
Years education	12.5	3.4	11.8	3.7	.24
MMSE	20.5	9.3	19.5	9.3	.53
FIM	98.1	40.0	100.1	39.6	.76

Note. Test *p* value is from independent-samples *t* tests for continuous variables and chi-square independence tests for categorical variables.

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Table 2

Descriptive Statistics for Outcome Variables at Each Assessment by Treatment Group

	Control			PST		
Caregiver outcomes	***n***	***M***	***SD***	***n***	***M***	***SD***
Caregiver outcomes						
Depression (CES-D)						
T1	73	13.6	12.1	74	17.9	12.4
T2	64	15.9	12.7	60	19.2	13.7
T3	58	15.1	11.5	57	19.1	13.6
T4	67	16.4	12.6	62	16.7	12.4
Physical symptoms (PILL)						
T1	73	11.6	9.0	74	12.6	7.8
T2	64	11.3	8.9	61	13.1	8.2
T3	57	11.3	8.4	57	14.0	7.9
T4	67	11.4	8.3	62	12.2	8.3
Satisfaction With Life (SWLS)						
T1	73	22.6	7.9	74	19.6	9.3
T2	64	21.3	7.3	62	19.6	9.5
T3	57	22.9	7.2	57	19.6	9.1
T4	67	23.9	7.0	63	20.7	9.4
Constructive problem-solving						
T1	73	65.1	16.8	74	58.0	14.9
T2	64	64.1	16.7	59	57.5	15.1
T3	58	62.2	19.4	57	59.0	17.0
T4	67	62.9	18.8	62	58.1	17.5
Dysfunctional problem-solving						
T1	73	22.9	19.0	74	30.0	18.4
T2	64	24.6	17.6	59	31.2	18.7
T3	58	22.2	18.9	57	31.6	20.5
T4	67	22.9	18.4	62	27.1	17.8
Burden						

	Control			PST		
Caregiver outcomes	***n***	***M***	***SD***	***n***	***M***	***SD***
T1	73	31.2	12.2	74	30.9	11.7
T2	64	32.1	11.3	60	33.2	12.0
T3	58	32.1	10.7	57	30.9	12.2
T4	67	30.0	10.7	62	31.2	11.8
Care recipient outcomes						
Depression (HAMD)						
T1	69	1.9	2.4	69	1.9	2.3
T2	59	1.9	2.9	57	1.8	2.4
T3	50	2.1	2.5	56	1.5	2.4
T4	57	1.9	2.3	57	1.1	1.7
Functional independence (FIM)						
T1	72	98.1	40.0	74	100.1	39.6
T4	65	96.4	41.1	63	99.2	37.8

Table 3

Correlations Between Outcome Variables at Baseline

	CES-D	PILL	SWLS	Constructive PS	Dysfunctional PS	Burden	FIM
Caregiver variables							
Depression (CES-D)	—						
Physical symptoms (PILL)	.65**	—					
Satisfaction With Life (SWLS)	−.60**	−.39**	—				
Constructive problem-solving	−.19*	−.01	.15	—			
Dysfunctional problem-solving	.54**	.37**	−.38**	−.46**	—		
Burden	.41**	.33**	−.43**	−.08	.33**	—	
Care recipient variables							
Functional independence (FIM)	.07	.15	.04	.03	.06	−.17*	—
Depression (HAMD)	.18*	.12	−.17*	.02	−.07	.08	.05

* $p < .05$.

** $p < .01$.

Table 4

Estimates of Latent Growth Models of Primary Outcome Variables

Caregiver outcomes	*B*	*SE*	*t*	χ^2	CFI	RMSEA
Depression (CES-D)				9.30	.99	.048
Int.	16.2	1.03	15.7***			
Var. (Int.)	44.2	17.0	5.54***			
Slope on Int.	.003	0.04	0.07			
Slope on treatment	−1.37	0.69	−1.99*			
Physical symptoms				8.32	.99	.036
Int.	12.5	0.68	18.3***			
Var. (Int.)	54.7	7.44	7.35***			
Slope on Int.	−0.02	0.03	−0.57			
Slope on treatment	0.08	0.35	0.24			
Satisfaction With Life				12.5	.98	.073
Int.	20.6	0.68	30.4***			
Var. (Int.)	49.2	6.26	7.85***			
Slope on Int.	0.01	0.02	0.40			
Slope on treatment	−0.30	0.37	0.81			
Constructive PS				7.80	1.00	.028
Int.	61.5	1.22	50.3***			
Var. (Int.)	162.7	28.2	5.77***			
Slope on Int.	0.09	0.04	2.14*			
Slope on treatment	2.21	0.86	2.57*			
Dysfunctional PS				10.2	.99	.056
Int.	27.2	1.49	18.2***			
Var. (Int.)	288.2	35.9	8.01***			
Slope on Int.	−0.02	0.02	−0.78			
Slope on treatment Care recipient outcomes	−1.40	0.61	−2.30*			
Depression (HAMD)				1.82	1.00	.001
Int.	2.03	0.19	10.5***			
Var. (Int.)	2.10	0.74	2.81**			

Caregiver outcomes	*B*	*SE*	*t*	χ^2	CFI	RMSEA
Slope on Int.	−0.02	0.07	−0.27			
Slope on treatment	−0.32	0.14	−2.37*			

Note. Int. = latent intercept; Var. (Int.) = variance of intercept; Slope on Int. =regression of latent slope on intercept (degree to which slope depends on initial status); Slope on treatment = regression of latent slope on treatment (indicates treatment effect on change); CFI = comparative fit index; RMSEA = root mean square error of approximation.

* $p < .05$.

** $p < .01$.